



SOUHEGAN TECHNICAL REVIEW COMMITTEE

NH Rivers Management and Protection Program

New Hampshire Department of Environmental Services
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Souhegan TRC Committee Meeting Minutes Monday, February 13, 2006 Fish and Game

Members Present:

Ralph W. Abele
Douglas Bechtel
Representative Richard T. Cooney
Dr. Kenneth D. Kimball, Chair
Vernon B. Lang
James MacCartney
Carl Paulsen
Thomas Roy, Vice Chair

Members Absent:

Jeff Deacon
Alden Greenwood
William C. Ingham
Dr. Brian R. Mrazik
John R. Nelson
Donald L. Ware

Others Present:

Robin (Wallace) Warren
Jeff Deacon
Drew Trested
Al Larson
Mark Hutchins
Don Kretchmer
Lee Carbonneau
Tom Ballestero
Joseph Rogers
Jeff Legros
Piotr Parasiewicz
John Magee
Doug Skene
William F. Ruoff
Spencer Brookes
Diane Fitzpatrick
F. Vincent Gerbino

Local Advisory Committee

USGS
Normandeau Associates
Normandeau Associates
Normandeau Associates
Normandeau Associates
Normandeau Associates
University of New Hampshire
NEIHP UMASS
NEIHP UMASS
NEIHP UMASS
NH Fish and Game
Pilgrim Foods, Greenville, New Hampshire
Director Public Works, Milford, New Hampshire
Souhegan LAC
Souhegan River LAC
Monadnock Mountain Spring Water

DES Staff Present:

Wayne Ives, Instream Flow Coordinator
Marie Loskamp, Executive Secretary, Watershed Management Bureau

9:30 – 9:45 Acceptance of November 28, 2005 minutes

Chair Ken Kimball opened the meeting and requested a motion to accept the minutes of the November 28, 2005 meeting.

- **Rep. Cooney made a motion to accept the minutes of the of the November 28, 2005 meeting as presented Vernon Lang seconded the motion, there was no discussion and the vote was unanimous to accept the minutes of November 28, 2005.**

Ken Kimball did an insert to the agenda, and asked Wayne to give us a quick update on the schedule. As you may remember, we were hoping to get a draft of the PISFs and then meet and discuss this draft. After our discussion we were looking at putting it out to meet the 30 day session before we move into the public hearing.

Wayne – We expected today to have the draft proposed PISF numbers ready for today. We do not have all of those yet, so we are going to present what we do have and also go into some specific discussions of the general water management plan so that we will see where the PISF numbers will lead us. The PISF numbers will be ready for March 13, 2006. There will be another meeting of this committee on March 13th and at that time we will have the proposed draft and you will be reviewing what we are going to propose for PISF to the public. After this group approves the draft proposed PISF then they become the proposed PISF study and it goes to the public hearing. The public hearing has to be held in the watersheds so we will be holding that 30 days after we go public. So we are looking at March 13th, a couple of weeks after that for some feedback and a response period to get this to the proposed stage. Then we need to have 30 days in public for comments and for people to review before the public hearing and then another 30 days after that before we can establish the actual PISF as PISF and not proposed anymore. That is the timeline, March 13 to end of March and then beginning of May for public hearing, mid June for established protected instream flow. Water Management Plan would be June to have draft out and discussions over the summer. Task V is the most time consuming and most in-depth, most amount of material and time go into it.

9:45 – 10:40 UNH/UMA/Normandeau Review result of PISF

Tom is emcee today. To follow up on the comments of Wayne, we have a lot of data to show you on what the instream flows should be for these different IPUOCRs. If you remember the last meeting, we went over basically how this project runs from soup to nuts, and we identified each of the characteristics of each of the tasks. Now we are at the point where we have come up a lot of data that support the fundamental numbers for ISFs. We were going to do this in one meeting but there is just so much to present, it is better if we show you some of the information this time, you get the report two or three weeks from now so that you can see how everything is put together and then two weeks after that, March 13th, we have another meeting and we are addressing the same information and the March 13th meeting should be a real productive meeting. Once we get these ISF numbers then we can go into management. We have all sorts of the components for the management plan already in place but until we know what the flows are, there really is nothing to manage.

- **The Power Point Presentation will be on the UNH Website and the DES Website in two to three days.**

Don Kretchmer – Recreation – We knew recreation on the Souhegan was an average flow, high point phenomena, and when we presented our IPUOCR list originally we indicated that if during the course of water management, we were going to affect the average or high flows on the river by either storage or knocking off the peaks, then we would deal with recreation in a more quantitative manner. We looked at it in a qualitative manner and did a survey, and have numbers as to what they prefer for flow. The primary IPUOCR is kayaking and canoeing, which is flow dependent at average to high flows. The upper sections of the river are not navigable at low flows. We had to walk a good portion of the upper system in summer because there was no way to float a boat through there.

Results of survey for boating population:

- Greenville section most popular;
- season - the spring snow melt is the most popular;
- whenever water is available they will go and run;
- used Stony Brook gauge and were dismayed that it was dismantled - used for flow on upper Souhegan;
- using Contoocook gauge as a surrogate gauge, more than the Merrimack gauge;
- better gauging would be welcome by the boating community; and

flat water sections even under very low flow, were still canoe able.

Questions:

Vern Lang – Did you convert your flow values at the Route 31 gauge crossing into cfsm values so that we could have comparisons?

Don – We can do that.

Diane Fitzpatrick – Do you have any idea how long it takes to row from Greenville to Wilton to Merrimack.

Tom – We actually had it measured for some hydrographs and depending on the pulse you are looking at and what they are doing with flash boards on dams, it can be anywhere as short as 6 to 8 hours to as long as 16 hours.

Lee Carbonneau– Wetlands - Natural Communities – We are evaluating flow change effects on natural communities using a flood plain transect method. This involves putting cover types around segments of the river and running transects across those and then surveying in those transects and the elevation differences between these natural communities and then plot water levels from different time periods during the growing season. Look at the potential changes in water levels under a different flow regime. Identify what the change in area could be from those shifting natural community boundaries if those flow regimes were to be somewhat constant and the change would be somewhat permanent. If we have habitat suitability information for a particular species in those communities that we are interested in, we can also apply that to calculation.

Question - Is that flood plain, or near flood plain that you are talking about?

Lee- Our transects went as best as possible from upland to upland on either side, not all of them did, but the flood plains that we included were at least 10 year flood plains.

High energy riverbank communities extend primarily from just below Greenville down to Route 101 about a five mile stretch. They did some transects and cover typing on what used to be called reach one, the designations on the river have changed, but our transect crossed what was more specifically known as twisted sedge, low river bank and also a fern glade. The twisted sedge community is from the edge of the summer water level to not more than a meter in elevation above that and fern glade would be right adjacent to that going up to the bank of the river where the forested canopy covers over. We found fern glade mostly in the shaded banks on southern edge of the river.

Several flood plain types, sycamores flood plain forests are in one location that we found in Milford and there is an Island that is surrounded by two different branches of the river and some additional flood plain along that. Sycamore flood plains are low flood plains, flooding every one to three years or more often than that. We did notice that the under story of this sycamore flood plain forest is primarily sugar maples and these trees may eventually replace the sycamores. We were speculating that some of the upstream changes that have already occurred by damming the river and realigning it along road construction may already be changing this community by reducing the flood flows in the spring. High spring flows are critical. Loss of water during summer could result in a permanent change. Oxbow and backwater marshes, these are the high and low marshes that are located either right along the stream channel or in small backwaters or oxbows depending on spring flows to fill and then drain slowly over the course of the summer. They are fairly well adapted to variations, but the draining in the summer gives you those concentric rings of vegetation. A loss of significant water during the summer could result in a permanent change of our water levels and looked at the photos in the power point presentation.

Vern – In photograph you seen to go right from aquatic bed to flood plain forest community. Would you have any instance where you run into buttonbush shrub swamp in between the aquatic bed and forest community?

Lee – That was quite rare in this case. We did not see many buttonbush swamps along the border except not buttonbush but where there was a fair amount of silky dogwood right on the very edge of the banks and that wasn't that common either. We did not see a lot of buttonbush swamps along here.

Some of the wildlife includes the wood turtle. There is some potential habitat in the low gradient part of the river. These are riparian species that will use the river channel and adjacent uplands. They have to negotiate the banks which in this case are fairly steep. It is not ideal wood turtle habitat but they

are using it. One of the important flow issues is winter flow because these turtles hibernate down in the banks, sometimes communally in a muskrat hole or under piles of debris that are in the channel or in the soft mud at the bottom. They are in their hibernation spots by mid November. So any flow reductions from mid-November through the winter could potentially expose hibernating turtles. Another sensitive flow could be a sudden release flood waters, sudden high flows in the summer after nesting. Flows that increase the entrenchment of the river or cause significant water velocity increases will degrade habitat for wood turtles.

Question – Have you touched bases with Florida Power and Light? They have actually done a lot of radio tagging of wood turtles up in the Dead River and taken a look at impacts on them and Bill Hanson is the person to contact.

Lee – I haven't but I will, thank you.

We found American Toads that are likely to breed in oxbow wetlands, backwater areas in shallow waters and they are sensitive to loss of water in those habitats while their eggs and tadpoles are developing. Permanent reductions in water levels if they start occurring in the spring would allow the toads to breed in water that remained permanent but if after breeding in April, May and June the water levels drop significantly, then those areas could become an actual sink for this species. Low summer flows after spring highs could be critical.

Some other wildlife species that we are concerned about but not as concerned as we thought we might be. We took a look at some of the wetland habitats that are adjacent to the river and are potentially flow dependent. Some of these wildlife like large wetlands, aquatic beds and usually 12 acres or more. We didn't find any that size that appear to be flow dependent on the Souhegan. Osprey and common loon are fish eating birds, do not nest along Souhegan, they have been recorded migrating through and only adversely affected if decline in food.

Questions:

Carl Paulsen – You and Don mentioned some resources that are potentially dependent on higher flows and it seems to me if I was working on a planning reference, I would want to know what my options were including skimming higher flows potentially, but the only way to do that is what impact would doing it have on some of these other resources. So, to what extent can you do some of that preliminary analysis to figure out just what are the bounds of those higher hypo-dependent resources?

Lee – I think we can. I think we can establish the flows that are typical of flooding these flow plain areas, we know the elevations and we can determine what those flows are and at least come up with a benchmark that if we were to see opportunities to actually decrease that significantly, we will have to revisit this, but yes I agree, we would definitely be keeping that in mind, we are not going to ignore it but we will probably not look at it in great detail unless that becomes an eventuality.

Carl – In terms of spring recreational flows, did you get a sense of just how low they could go and still provide a good spring...?

Don – They all said 700 and they would not consider running it. They were grumbling even at 760, and said that this really isn't enough.

Carl – My point is that doing it in the spring, a reliable experience may be different from what can I scrape by on.

Don – I think 1200 was what they were looking for, that was the most fun and then they could safely run and have a good time.

Carl – Would that number go to the planning group as a target?

Don – Yes, absolutely. If one of the alternatives in this whole mix of alternatives for managing water is to skim spring flows, if that changes that number significantly, it will be taken into consideration.

Rep. Cooney – I have a question on flow rates, you said that these various sections, these flow rates, you took those flow rates at that point, not extrapolate from the Merrimack.

Lee – No, we are doing the same extrapolation but the water levels that you see on the cross sections are our observations during our transect visits. We are also using that data from the Merrimack gauging station and the calculation to find out how those flows relate to the water levels that we observe there. It is a pretty good fit, so we are using both of those methods.

10:30 – 11:45 UNH – Specifics of a generic Water Management Plan

Tom – While we are setting up, the first thing, as with all our past presentations, these are going to be on our website probably by Monday of next week. The second thing, about the flows, what we did in this study was concurrent flow models. We would wait anywhere from three to five days after any precipitation event so at systems it is steady state. You have the flows measured at the Merrimack and we would actually measure flows at different places upstream. The time honored way of estimating flows somewhere else when you have a gauge on the system is to just use a simple period waiting factor. What we found was simple area waiting factor works good from a gauge upstream to about Boston Post Road. It starts to break down after that. It is not a linear function. If you use the simple linear function you can over predict the amount of water that is in the river.

Question – What is the return on a 1200 cfs?

Tom – I haven't looked at that, I cannot give you an exact number, I am guessing that somewhere in the 1 ½ to five year range.

Question – What is the kilo load?

Tom – I will post that on our web site.

Question – Lee, as far as that sycamore island, you said that wasn't over cut by the flow in 2005, and do you have an idea of what the discharge was on that?

Lee – I do not but I will look that up for you.

Question – Do we know what the effects of the upstream impoundments of hydros are on the flow?

Don – I think part of that is that the peak had already passed. Some of the boaters said that the day before I was out there, which was the 9th, flows were significantly higher upstream. The other part of the answer is that there are a lot of passive flood control impoundments upstream that knock off the peaks and they are doing what they were designed to do.

Doug – Did you see many invasive species in the flood planes?

Lee – We did in some locations particularly around sycamore flood plane forests. There is both upland invasives like Asiatic bittersweet, Japanese honeysuckle, but we also saw a fair amount of purple loosestrife in the channel itself, probably more in that area than almost anywhere else. This could be some remnant influence of having altered hydrology in the past. That location also had a great deal of Japanese knotweed along the river banks.

Mark Hutchins - Water Supply/Water Management Plan – As Tom said we do not have a water management plan at this point. It naturally follows the establishment of the protected instream flow numbers and since we don't have those, we don't have anything quantitative to work with or locational to work with for a water management plan. Even so, we have been active in the watershed, collecting information about the effected water users, the hydro and other dams in the area. Water management plan will have three components: One is water use and how can we modify use to increase flows in the Souhegan. Conservation is obviously another factor, how can we reduce water use in the Souhegan. Lastly, dam management, we have a whole host of dams in the watershed as we do in most watersheds of different types, do we have any options for modifying use of those dams to increase minimum flows. As you can imagine the various resource needs and the uses of water for various purposes typically results in conflicts between users and resources.

We have looked at various uses in watershed, both with respect to affected water users and affected dam owners. We have a couple of golf courses whose primary use is mostly summer use. We have several municipal water supplies in the watershed which are year round uses and essentially constant use throughout the year. We have hydropower in the watershed and it is primarily a use from fall to spring, because that is when the water is available. An industrial/commercial component including a food processing whose water supply is entirely through a municipal source. There is a commercial use of water also which is primarily a summer use of five to six days a week use during the business hours. There are agricultural uses which are again summer uses, and a fish hatchery which is a substantial use in watershed which is essentially a year round constant use.

Quantification of uses – Just for purposes of looking at that use we selected the average August withdrawal as reported to the state. We divided the watershed into two regions to show that where water is needed may strongly influence the composition of the water management plan. One section is upstream of Wilton and we have the lower section which is upstream of the Merrimack River which is

the entire river. The thing to notice is that in the upper portion of the watershed we have essentially two users with an average August use of .44 cfs. It is a lot of water and not a lot of potential to mitigate. In the lower watershed however there is substantial more use at least for an average August withdrawal we are looking at 3.2 cfs. It is conceivable withdrawal from Souhegan could be 5 or 6 cfs. Structure so withdrawals do not all take place at the same time. Some withdrawals have return flows from waste water treatment and fish hatchery, half is returned. We are looking at a short term consumptive use of something on the order of 1.5 cfs. The effected dam owners are scattered though out the watershed and the potential for any particular facility to enhance minimum flows is dependent on where you need the minimum flow, you need to increase water.

Looked at all dams and lakes, everything that has some storage as reported by the state and have concluded is that the main stem dams, the hydro dams, have no useable storage. These are narrow, run of the river impoundments and they simply do not have enough storage to mitigate flow in Souhegan. The lakes and ponds likewise have limited storage potential. Some of these impounds have various recreational uses, seasonal and permanent dwellings, and the likelihood that you would be able to have a summer drawdown is extremely limited.

There are flood control structures in the upper watershed. It is unusual that there are many of them (7) in the upper portion of watershed which have substantial storage capacity and usually unused storage capacity. They are owned and managed by the state.

What we first attempted to do is look at what is the potential for impoundments as a whole and in particular the storage facilities to augment flow. This is strictly theoretical and is based entirely on the full pond capacity of all of the facilities, and all of the entire storage capacity that is available and assuming it can all be released when you want it. We divided the watershed into two sections one upstream of Wilton and one upstream from the Merrimack and you can see the flood control structures are all located above Wilton. If all were managed to augment flow, then the capacity of these flood controls structures would be to release a flow of 176 cfs for a 30 day period from those structures, and over a seven day period 757 cfs. Now obviously it is not feasible or desirable to develop that much storage capacity. Even so it does strongly suggest that when we are talking about potential to mitigate maybe a few cfs of flow that the flood control structures certainly look attractive.

The other facilities are significantly less, they are more numerous and they would be more difficult operationally to be able to utilize that storage.

Importantly the flood control structures at least some of these structures could affectively augment flow for virtually the entire river, at least the river in New Hampshire. These facilities are typically an earthen dam maintaining a low permanent pool surrounded by typically wetland vegetation, but not everywhere. The outlet structure is essentially a passively operated structure, water comes in and water goes out depending on the level with no operational requirements. Under high flow situations this upper section would operating as the flow control structure.

Dr. Kimball – Just a quick question on that. If I remember at the last meeting there was some discussion about some of storages may cause some thermal issues relative to downstream species and the questions I have is to modify these if you are going to try and get storage and also deal with the thermal issue, you really have to rebuild these to have different intakes and so forth?

Mark – Yes, actually on the next slide. At this stage from a water quantity stand point, they look attractive. They are already there, they are already functioning, they are already skimming water, but to what extent they are modifying big flows, we do not know because we haven't investigated that. It certainly could be investigated. They come with their own set of problems because they were designed for flood control. If we were to use even one of them for flow augmentation, then we have eliminated that capacity of that facility to serve for flood control unless operationally we can drawdown in the event that a significant rain event is forecast to recreate the available storage. There are potential water quality issues, dissolved oxygen and nutrients, biggest issue is temperature. Temperature in upper reaches declines as it goes downstream temperature is influenced by existing storage facilities. If we were to release significant amounts of water from these flood storage facilities, then that additional water would carry the same temperature, so you might be defeating the purpose of flow release by eliminating habitat. There would be habitat changes associated with the impoundment. These impoundments are multi-purpose, they have flood storage function, they have a recreational function and they have a wildlife/wetlands function. If we were to permanently or during the summer increase

the pool level, then we would at a minimum be changing the habitat value associated with the impoundment and we might be losing some.

There would be some capital and operational costs associated with this. These outlet structures would have to be redesigned. Then there are potential engineering and geotechnical considerations and we do not know if these are significant or not. These facilities were all designed to store water and to be overtopped but for periods of days or perhaps weeks, and we would be looking at a potential use on the order of months. It is conceivable that the structures were not built to hold water for periods of months. We need to have hard numbers and where water is needed. We have a sense of what the uses in the watershed and where we might be able to provide some augmentation.

Tom - The waters users are willing to make sacrifices if they can see a tangible result.

Question - Willing to do something that quantifies in terms of dollars?

Mark - That is part of our charge, we are supposed to be coming up with the cost to deal with some of these issues and the big fear from industry and local business was that when the instream flow period comes, you cannot divert anymore, you have to build this big storage tank somewhere because that is going to be your water supply during low flow times. In this watershed it does appear that water use can be compared to the stream flow. There is a lot of water storage capability in the watershed it could be behind these flood control reservoirs. There are some good stratified drift deposits up in Greenville, you could actually use artificial aquifer recharge and that would kill two birds with one stone. You are skipping the same high flows but instead of putting in behind reservoir and letting it heat up in the summer, you put it into the ground and you will have much cooler water coming out. There are costs associated with doing that. The issue now is we have to identify, okay when the Merrimack gauge is at 50 cfs, it is 8 cfs up at Greenville, and it is going to be a certain fish species that will be affected. That species would rather have instead of 8 cfs, 10 cfs. My question is how do we get 2 cfs at that location.

Tom - Part of this process is the elimination process. Obviously somebody down stream from Greenville cannot help out. The down side of proposing strategy with artificial recharge aquifers is you have to keep doing it when you don't know the future. Using reservoirs you can use operational strategies that are at least close.

Ken - Will the final matrix that comes out show the trade offs. I am assuming it will, but will it be fairly clear because obviously it is going to be impossible to hit 100% of every human activity.

Tom - Actually Tom Seager came up with this diagram, and it is on the diagram but it is a matrix, it is exactly as you identified and the water management plan is a series of sequences that you could follow. A lot of this will not need monitoring. You can say that this is the path that we are going to be following, whether or not that happens is another issue. It may bring in a role with the state, because this isn't the only designated reach in the state. The state owns the most number of dams.

Ken - You can do the skimming, but you would probably be sacrificing some of your plant species of concern and your white water boating, and a lot of other stuff because they all depend on high flows and those are the kinds of tradeoffs.

Wayne - This is what we are trying to document so that people can recognize there is the public policy and do we want to have one thing or the other. We do have to make some decisions and if there is a place we can't reach without doing something, and if we were to decide take one path or the other and that is what we are going to have to do. Here are the quantifiable numbers saying if you do this and don't do that you are going to end up with these results. That is what we are trying to provide here so that when we get to the public discussion people can say this is the preference and is the best path possible and we may be charged with this process. Representative Cooney, as far as the economic stuff, that is part of what they are required to do and generate for the water users and the dam owners what would the cost be in order to reach the reconstruction of the dam or to have an affected water users do some kind of conservation or to install storage tank if that what it comes down to. Before it even goes to the draft water management plan is part of the discussion with the water user, so we reach a point where economics make sense. When it comes back to these committees, all of those numbers will be presented as this is the discussion we had with the water users and the dam owners and we can all tell exactly what we think the costs are going to be.

Mark - What we see out there now is reflective of the existing withdrawals, it is reflective of existing impoundments, and it is reflecting the skimming that has already taken place. The question is

what is out there now that we don't like and what we can do to improve it and how do we do that or what we have eliminated.

Carl – I would go back to the comment that Dick made about the two water withdrawals upstream of Wilton and I think they total up to about .4 cfs, and I am just wondering how that relates to some percentage of base flow as compared with the withdrawals downstream as a percentage of some base flow.

Mark – I don't have those numbers Tom do you?

Tom – I ran all of those numbers.

Mark – We have them but not with us.

Tom – That is a number I am going to have to get back to you but it is a small fraction.

Carl – What I am getting at is that just thinking about the numbers for peak flow, you were talking about the gauge down near the confluence. The peak flow down there let us say is at 700 cfs might equate to 70 cfs upstream in Greenville and so if you think about it comparably at the base flow stage .4cfs withdrawal is roughly 10% of total withdrawal of whatever it was but at any rate which is roughly 10%. If your base load is prorated in such way that the base load is 10%, it strikes me that the water withdrawal up there potentially represents as large a percentage of the base flow as it does downstream. I think that more looking at the overall package and how things are related that is going to be an important number now.

Mark – To make a difficult situation even more difficult to explain there are those two sources up there that are at .2 cfs. One is in Greenville which affects that whole rapids reach all the way down to Wilton. The other one is on Stony Brook which comes in at Wilton. Basically only half of that upper part you can deal with as one user, one knob to turn which is Greenville .23 cfs which is not a lot.

Piotr Parasiewicz – Habitat Issues - Review of Target Fish Community

Piotr showed 60 slides. It is the nature of their work that for a long time we are collecting all the data and then we have an avalanche of results coming at us and it is difficult to summarize it quickly and in one meeting.

Piotr gave a review of the target fish community, the task that he reported on recently, and more information about existing fauna, about bio-periods and selected indicators, species, development of how a suitability model, results of habitat suitability mapping, and tell you what we still need to complete within the Task 5.

Target fish community – we divided up originally and we wanted to develop a target fish community as a desirable target for this river. What we would have in the river would be something that we are happy with. We are planning to go a step further to develop reference fish community but we had to drop this area because of a lack of labor. The first step in the development of target fish community was to divide river into two different portions, and there are multiple reasons for doing this. We have a different gradient and we have different ecoregions so we basically dealt with Souhegan A and Souhegan B, upstream and downstream. Upper region graphs show expected proportions of fish and historical data, type specific data, fish that should be there. We collected fish in two portions of the river with two different methods. In the upper river we mostly used the grid electro fishing technique and electrocuted the fish and counted the species and also noted the habitat that we found at the location. We had 133 grids that we placed in the river, 24 had no fish, 576 had fish collected, 11 species, two non-native species, about 4.3 fish per grid in average and compared to other streams in area it is below average. Upper Souhegan community when compared to the target fish community model, there is an index that calculates it, and it resembles it to 61 percent, 87 percent were fluvial specialists and 8 percent fluvial dependent. About 90 percent were riverine fish and 5 percent were macrohabitat generalist so more or less pond fish.

Target fish community is developed using the samples from multiple rivers and then apply formula that fits into the parallel line. This takes into account regional and seasonal variations. We do the same thing with relative abundance we have multiple samples on the rivers and then apply the same formula and fit into the parallel. And then assume that this reflects and takes into account seasonal variation. You are comparing apples to apples. Target fish community, expected proportions of species, and this is existing fish communities and treat it with the formula again excellent proportions and then the

abundance, pretty interesting comparison this data includes exotic fish communities, pumpkin seed is native, so obviously in ball park.

The lower river sampled using snorkeling techniques, Jeff was basically snorkeling down the river and counting all the fish and identifying all the fish he had seen. He snorkeled about 37 hydro-morphologic units and very close to runs that we identified based on our mapping. He had seen almost 2000 fish of 16 species, 5 of them non-native, and fitting the index as I mentioned before, between target fish community and existing fish community is about 53 percent, 41 fluvial specialists, 43 fluvial dependent and 16 macrohabitat generalists. Species are of special interest, species help us with flows required for seasons.

Selected only a few fish that we wanted to deal with in our habitat models and in our habitat analysis and first we took into account what we obviously know are underrepresented and call them the species of special interest. We have five most dominate species in those target fish communities and we call them generic resident fish and those species have been selected to guide us through the process of flow needs for specific seasons. One of the first steps is to divide the flow time series of the river for the year into bio-periods: winter survival, flood storage period, flooding period, fish spawning period, fish growing season, in the fall the habitat for Atlantic salmon and then we are back into winter survival. Since we have the species, we have the indicators, and the next step was to ask them what it is they need. Many of them we have developed habitat use criteria or habitat suitability criteria for specific periods like spawning we would use literature data and develop for the five species some specific temperature, habitat, etc. The modeling technique that we have used, we analyzed different locations in the river and basically found that if one or more of these attributes are found in one specific unit, if this is a habitat, then it has probability or high potential for spawning. If the three of those were met, then it was considered to be a good suitable habitat. We developed similar models for mussels we found three mussel species in the river. Another survey conducted was for macroinvertebrates, dragon and damselflies. Those are identified as species that potentially might be affected by flows or are most affected by flows. We did not divide them according to specific groups or species we lumped all the organics together.

We have developed a habitat suitability criteria based on the observations of fish presence in specific locations and habitat characteristics around for mussels, dragon flies and damselflies. For fish we used data collected on different rivers. We have developed multi-variant models with a complex formula that allowed us to select the attributes that correlate with the presence or absence.

Just for your information, attributes that have been selected for brook trout, this will be on the web page so you will have a chance to see if you agree with this information with brook trout and slimy sculpin. This is for the special interest species: American eel, Atlantic salmon, mussels and odonates. Interestingly, this is something I need to draw your attention to, for the mussels we found only two attributes to correlate at least a presence. This was based on our 200 grids data collected in the river and this was sand and fine gravel. It was different for the odonates, obviously depth and canopy shading correlated with the present day assumption.

Within our data set we calculated probability of fish presence and probability of fish abundance with two models. We used these two models based on relatively complex technique of analyzing our predictions. We defined three classes of habitat, unsuitable habitat where the probability of presence was lower than current value selected from observed abundances, the suitable habitat was when we had probability of presence high but the probability of abundance was low. The ultimate habitat was when both probabilities were very high. Three classes of habitat suitable have been developed for this. The fish data used for development of these models have been taken from different rivers and our fishing data was used to verify our models and to determine if really the place that we predicted that fish would be present will have more fish. One thing I have to say upfront is remember that we are watching here only physical attributes and I am not the only driver of fish behavior so our data is expected to be noisy. The river is not pristine and the habitat is not absolutely saturated. There is not such a dense abundance of fish that we would expect the fish to be distributed really according to the habitats. We should expect some noise in our data but on the other hand we look for a correlation between the species. Here we had to make some decisions. The three points that messed us up are all in one particular location in site three. The location was next to the pipe of the wastewater treatment plant. It is surprising why we have such a high abundance of fish there. We decided to remove these points and this changed things pretty

dramatically, got rid of common shiners, not use it for validation and then develop a validation relationship that showed us that we have pretty high correlation between the prediction and the number of fish that we covered for particular areas. This is the average probability of presence and abundance for all of these species.

For the snorkeling survey was not as precise or not so quantitative because it really is harder to get particular grids so we expected more noise but still we got low r^2 numbers but still very significant relationship between the species. We have higher numbers of fish in areas of better habitat.

We develop our own models based on data summary taken from somewhere else. We verified it and it works, we got the number of species that we wanted to be our indicators for specific seasons, and now we went to the river and mapped the river at many places to see if these species are having sufficient habitat when they need it. We covered numerous areas. As we have learned more about a river, and we developed our thinking about it, our numbering system has developed also.

Ken – The Lamprey Meeting starts at 1:00 pm, the RMAC meets at 12:30 pm. Is there anybody here that cannot go to 12:45? We were scheduled to finish here at 11:30 am. We will continue for another 15 minutes.

Piotr - The result of this mapping is we now have 750 maps with different colors for different habitat suitability. What is interesting to see is how the river develops as the flows are increasing.

Ralph Abele – When you go through those three scenarios, you tried to go 0.2, 0.5 and 1.0 but you actually had the actuals.

Piotr- Yes, these are the actual flows based on our concurrent flows. In viewing these Yellow is good, green is great. The reason why we do it we want to distinguish between fish have excellent habitat among good habitat. If we were to go with only one class, a lot of poor habitat would be as good as a lot of very good habitat, very little of a good habitat. We are specifically watching for a proportion of optimal habitat within the suitable. Areas that have only suitable habitat have much less value for us than those that have optimal locations.

This summaries what you see on all these graphs, these are rating curves that count the amount of yellow area in one site at different flow conditions. Now you can see how the suitable habitat is increasing for example to a common shiner as the flows are increasing and then drops down.

It is not surprising that lower sites are different than upper sites. The Upper Souhegan has plenty of habitat for target fish community. Upper Souhegan with regard to American eel we have increase of .5 but for the Atlantic salmon there is getting more habitat, the more water the more habitat, so it is actually more happy about 1 cfs. So the answer is here if you want to manage for Atlantic salmon, we probably need more water. Lower Souhegan, same bowl of spaghetti, we have one very interesting story here. We were very curious about a fact that for some species we have such a drop in habitat and then we went to our mapping and realized that the mapping at this time was a year before (2004) and we had two floods going through the area. This particular site seems to be vulnerable to flood changes.

The Lower Souhegan there doesn't seem to be much of an issue for the entire lower section, however, at site 10 which is at Turkey Hill Bridge, it was interesting that we say so much of this habitat and Jeff confirmed that this was the place to see fish, apparently this is the area where fish are limited by habitat availability. Again there are special interest species and now we see action within mussels, lot of habitat for mussels and we have seen a lot of mussels. There is some action for odonates however we don't see any particular preference for flows, mussels and odonates will not be a very good indicator for determination of flow settings. If one fish needs one square meter of habitat regardless of what species it is, they need the same amount of habitat to survive, and we would want to have proportions between the habitat distribution and fish distribution to be pretty similar.

Maps for spawning, apparently the area of Monadnock wells, sites 3 and 4, are good for spawning for multiple species. They are good for spawning shad, Atlantic salmon, and resident fauna. This is downstream and the amount of habitat is increasing with the amount of water.

Average temperature measurements are from over two years. We have this interesting pattern that we have high temperatures in the top and then temperature drop and then it increases again which is more normal. We have pretty high summer temperatures about 25 degrees and that the impoundments on top contribute to this. 2005 was a much warmer than 2004. To complete our work we still need to simulate habitat improvements. Consider how the river would look without dams and with wooded

debris and side arms and backwaters. We have to conduct habitat time series, the cut curves, and develop final recommendations and reporting.

Questions:

Ralph Abele – It seemed like there was a range of flows in general that you were not mapping, a lot were less than .5 factor and I understand that you are dealing with nature and all that, can you factor that in to what you are doing or did you actually go out and map a wider area river than the flow itself indicated.

Piotr- That is our top flow at the moment. The only thing that we can do is extrapolate.

Tom -There is also a reality there, we have higher than about 0.8 cfs. Mapping is one thing and a management plan is another.

Ralph – If you are showing a peak at .5 and in fact you don't have any data that is all I am saying.

Piotr – The two worst cases are this .6 on two sites, everything else goes to .8 and falls close to 1. At the higher end we have some inaccuracy and our peak going up to the peak would stay as it is that if there is a drop it may be more or less dramatic. Remember that concurrent observations are having quite a level of inaccuracy.

It is impossible to superimpose, there were several observations in the field that were under specific conditions, under specific ground water level, after a specific rain events or before rain events that might end up in very different flows in the upper river at different times. Measurements were not taken at the very same time as we were mapping.

11:45 – 11:54 Other Business

- 1) Next meeting March 13th in AM.
- 2) Don Kretchmer is moving on to the NH Lakes Association and Al Larson will be heading up for Normandeau efforts. Al Larson is replacing Don Kretchmer. Al has been involved since the beginning. It is a tough loss but we will be seeing much more of Don Kretchmer. Don will be on the other side of the table.
- 3) Spencer Brooks from the Souhegan Local Advisory Committee and they have come up with a new brochure, showing the Souhegan River watershed. It does talk about specific things happening in the watershed or specific locations within the watershed and things that are going on. One of the things it talks about is the instream flow program. Copies are available at the back of the room.

11:54 Meeting adjourned.